Appendix A-E

Quality Management Plan for Geotechnical Engineering and Design

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Changes to this document require the concurrence of the Management Representative and approval by the Chief, ED-G, and shall only be made following the procedures described herein.

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APPENDICES

1. Purpose. This Quality Management Plan (QMP) defines the responsibilities and procedures for managing the

quality of geotechnical design and project support services and products delivered to Sacramento District customers by Architect-Engineering (A-E) firms and In-House design staff. The activities cited in this QMP are in accord with requirements specified in ER 1110-1-12, Quality Management, dated 1 June 1993, CESPD R 1110-1-8, Quality Management Plan, dated 14 December 1998, and specific QMPs developed for other applicable Engineering Branches and functional Divisions in the District.

2. Scope. This QMP applies to all elements and personnel of the Geotechnical Branch, Architect-Engineer (A-E) firms, and as appropriate, to Civil Design Branch, Military Design Branch, and Cost Engineering Branch. This QMP also applies indirectly to all functional divisions that support Geotechnical Branch activities.

3. References. Depending upon the type of project, funding sources, and design complexity, various combinations of regulations, manuals, and guidance may apply. The primary engineering documents containing guidance and design criteria that apply to Branch products and services for Military and Civil Works projects are listed below:

3.1 General

a. ER 1110-1-12, Quality Management, dated 1 June 1993.
b. CESPD R 1110-1-8, Quality Management Plan, dated 14 December 1998.
c. EC 1165-2-203, Technical and Policy Compliance Review, dated 15 October 1996.

3.2 Military and Civil Works Design and Construction

a. ER 1110-2-1150, Engineering and Design for Civil Works Projects, dated 31 August 1999.
b. ER 1110-345-100, Design Policy for Military Construction, dated 15 February 1994.
c. EM 1110-1-1000, Photogrammetric Mapping, dated 31 March 1993.
d. EM 1110-1-1005, Topographic Surveying, dated 31 August 1994.
e. EM 1110-1-1802, Geophysical Exploration in Engineering and Environmental Investigations, dated 31 August 1995.
f. EM 1110-1-1804, Geotechnical Investigations, dated 29 February 1984.
g. EM 1110-2-1911, Construction Control for Earth and Rock-Fill Dams, dated 30 September 1995.
h. EM 1110-2-1913, Design and Construction of Levees, dated 30 June 1996.
i. EM 1110-2-2300, Earth and Rock-Fill Dams General Design and Construction Considerations, dated 31 July 1994.
j. ER 1110-1-261, Quality Assurance of Laboratory Testing Procedures, dated 28 April 1999 (Errata No. 1: 15 June 1999).
k. ER 1110-1-8100, Laboratory Investigations and Testing, dated 30 December 1994.
l. ER 1110-2-112, Required Visits to the Construction Sites by Design Personnel, dated 15 April 1992.
m. ER 1110-1-1901, Project Geotechnical and Concrete Materials Completion Report for Major USACE Projects, dated 22 February 1999.

3.3 Periodic Inspection of Reservoir Projects

a. Federal Guidelines for Dam Safety, dated 25 June 1979.
b. ER 1110-2-100, Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures, dated 15 February 1995.
c. OM 1110-2-100, SPD Supplement No. 1 to ER 1110-2-100, dated 11 May 1987.
d. SPD Standard Operating Procedures (SOP) for Periodic Inspections.

e. ER 1110-2-101, Reporting of Evidence of Distress of Civil Works Structures, dated 15 March 1996.

f. ER 1110-2-1802, Reporting Earthquake Effects, 25 July 1979.

g. SPK OM 500-1-5, Emergency Employment of Army and Other Resources Emergency Dam Alert, dated 6 February 1985.

h. SPK OM 1110-2-4, Post-Earthquake, Preflood, and Periodic Inspections and Continuing Evaluations of Completed Civil Works Structures, dated 15 April 1999.

3.4 Periodic Bridge Inspections

a. Federal Regulation 23 Highways - Part 650.

b. FHWA Bridge Inspector's Training Manual/90, dated July 1991.

c. Manual for Condition Evaluation of Bridges, American Association of State Highway and Transportation Officials (AASHTO), dated 1994.

d. Standard Specifications for Highway Bridges (AASHTO), dated 1992.

e. Interim Specifications - Bridges (AASHTO), dated 1993.

f. FHWA Underwater Inspection of Bridges, dated November 1989.

g. ER 1110-2-111, Periodic Safety Inspection and Continuing Evaluation of USACE Bridges, dated 30 April 1997.

h. EM 1110-2-2002, Evaluation and Repair of Concrete Structures, dated 30 June 1995.

i. See also references "e" and "h", Para 3.3 above.

3.5 Dam Safety Assurance

a. ER 1110-2-1806, Earthquake Design and Evaluation of Civil Works Projects, dated 31 July 1995.

b. ER 1110-2-1155, Dam Safety Assurance Program, dated 12 September 1997.

c. HQUSACE Memo dated 7 February 1997, Subject: Seismic Safety Evaluation of Embankment Dams for USACE Civil Works Projects.

3.6 Dam Safety Training

a. ER 1110-2-1156, Dam Safety - Organization, Responsibilities, and Activities, dated 31 July 1992.

b. TADS (Training Aids for Dam Safety)

c. EP 1110-2-13, Dam Safety Preparedness, 28 June 1996.

d. See also reference "a", Para 3.3 above.

3.7 Dam Safety Instrumentation

a. ER 1110-2-103, Strong Motion Instrumentation for Recording Earthquake Motions on Dams, dated 10 December 1981.

b. ER 1110-2-110, Instrumentation for Safety - Evaluations of Civil Works Projects, dated 8 July 1985.

c. EM 1110-2-1914, Design, Construction, and Maintenance of Relief Wells, dated 29 May 1992.

d. EM 1110-2-1908, Instrumentation of Embankment Dams and Levees, dated 30 June 1995.

e. EM 1110-2-4300, Instrumentation for Concrete Structures, dated 30 November 1987.

f. See also references "i" (Para 3.2); "a", "b", "c", "e", "f", "g", and "h" (Para 3.3); "g" (Para 3.4); "a" and "b" (Para 3.5); and "c" (Para 3.6).

4. Definitions.

a. Customer: The owner, client, local sponsor, user or beneficiary of a service or product.

b. Quality: Conformance to properly developed and agreed upon requirements.

c. Dam Safety Inspection Team: Members from Engineering Division responsible for implementing the District Dam Safety Program.

d. Dam Safety Training Team: Members of Geotechnical Branch responsible for implementing the District Dam Safety Training Program.

e. Dam Safety Coordinator: Chief, Project Support Section.

f. Dam Safety Officer: Chief, Engineering Division.

g. Policy Compliance and Criteria Reviews (PCCRs): The seismic safety evaluation process is conducted in phased increments of study. Policy Compliance and Criteria Reviews (PCCRs) are scheduled to validate technical conclusions and policy compliance as an integral part of each stage (phase) of the process thus eliminating the need for several report submissions and approving cycles preceding the development of an official decision document.

h. Threshold Flood (TF): The Threshold Flood is the flood that fully utilizes the existing dam, i.e., the flood that just exceeds the design maximum water surface elevation at the dam (top of the dam minus freeboard).

i. Base Safety Condition (BSC): The Base Safety Condition (BSC) is met when a dam failure related to hydraulic capacity will result in no significant increase in downstream hazard over the hazard that would have existed from releases and spillway flows if the dam had not failed.

j. Dam Safety Instrumentation: Any of a variety of mechanisms used to enable the designers to monitor and evaluate the safety of a flood control or navigation structure during the construction period and under all operation conditions, and furnish data on behavior for application to future design.

5. Responsibilities. The Geotechnical Branch is responsible for the technical sufficiency, planning and accomplishment of the District's requirements for topographic surveying and mapping; accomplishment of geological, materials, and geotechnical studies, including field exploration activities and laboratory testing; management of the dam safety inspection program and report preparation for inspection of completed Civil Works projects, and; management of the dam safety assurance program activities of the District. Area of responsibility encompasses the preparation and administration of field exploration contracts, engineering analyses and design, development of technical reports, design memoranda, and plans and specifications for geotechnical features of work, including dam safety remediation repair. Open-end A-E contract resources are used when necessary to complement in-house resources. The Branch maintains accountability and responsibility for all technical products and services produced, whether designed by in-house or A-E forces.

6. Quality Management.

6.1 Civil Works Projects

ER 1110-2-1150 sets out engineering requirements, responsibilities, and procedures during

all phases of Civil Works projects, including engineering and project management functions. For quality management, the product depends on the phase of design.

6.1.1 Reconnaissance Phase: The Geotechnical Branch actively participates with Planning Division and/or Civil Design Branch in developing conceptual design alternatives for Civil Works projects. The Branch develops geotechnical data for preparation of cost estimates for the feasibility phase of study. The Branch develops sufficient geotechnical information so that preliminary alternatives can be evaluated for an engineering solution. The availability of existing geotechnical data is evaluated for each project. This information is obtained from Corps files and other federal or local agencies. Site visits are also performed by engineers from Soil Design Section and geologists from the Geology and Mapping Section. The purpose of the site visit is to obtain first-hand knowledge of conditions that could significantly impact the overall cost of the project. A preliminary assessment is made of the foundation conditions and potential borrow sources. A geotechnical report of findings during the reconnaissance phase is provided for inclusion into the reconnaissance report.

6.1.2 Feasibility Phase: Sufficient geotechnical data is developed during this phase to verify the project plan, site selection, foundation design, selection of structures and cost estimates. Soil Design and Geology and Mapping Section determine the scope of the exploration program. As appropriate, explorations include foundation and borrow investigations, geophysical, and groundwater testing. Geology and Mapping Section prepares the exploration contract, administers the contract, performs the field logging of the explorations and provides a summary report of findings. The exploration and laboratory testing programs are sufficient for preliminary design and developing information to estimate geotechnical aspects of overall project construction costs. When plans and specifications are not preceded by a Design Memorandum (DM), sufficient geotechnical information is included in the Basis of Design. When a DM is prepared prior to preparation of plans and specifications, a description of any additional exploration, laboratory testing and analysis is provided in the Basis of Design report.

6.1.3 Preconstruction Engineering and Design (PED) Phase: The Geotechnical Branch finalizes the necessary exploration and laboratory programs to determine final design parameters for the project. As appropriate, foundation conditions, seepage analyses, estimated settlement, slope stability analyses, and assessing any potential seismicity impacts to a project are completed during this phase to finalize design features and provide necessary design information for preparation of the plans and specifications. This geotechnical documentation is included in the geotechnical portions of the DM.

6.1.4 Construction Phase: During the construction phase, Geotechnical Branch prepares the geotechnical portions of the plans and specifications for construction of the project. Appropriate portions of the Engineering Considerations and Instructions to Field Personnel (ECIFP) are provided to the PM for inclusion in the ECIFP document. Field visits are made during construction to ensure designs and modifications to designs meet the design intent.

6.1.5 Operations Phase: During the operations phase of the project, Geotechnical Branch personnel provide support to the operations and maintenance activities of the Sacramento District. This includes any rehabilitation activities that require geotechnical expertise, including investigations or explorations, redesign and preparation of plans and specifications. The dam safety inspection and dam safety assurance programs, periodic bridge inspections, dam safety training, and dam safety instrumentation activities are discussed in paragraph 6.3, Project Support Functions.

6.2 Military Projects

The Geotechnical Branch supports the District's role in MILCON design by participating as a design team

member for in-house and A-E MILCON design projects or design-build contracts. Participating as a design team member, the Soil Design Section provides the geotechnical expertise in the design of foundations, roads, airfield pavements, and material investigations for concrete or aggregate products. Maximum use is made of existing information for the preliminary geotechnical report. In developing the final geotechnical report, the Soil Design Section determines appropriate exploration and laboratory testing programs. The requirements of the exploration program are provided to the Geology and Mapping Section, who prepares and administers the exploration contract and provides a summary report of findings. The final geotechnical report is prepared for inclusion into the Basis of Design for in-house and A-E designs or into design-build contracts. Exploration logs, site maps and other plates as necessary, and geotechnical-related specifications are prepared, as requested, for inclusion with the contract plans and specifications.

6.2.1 Coordination of Work Effort: The Military Design Branch Project Manager (PM)/Project Engineer (PE) is the point of contact for geotechnical design efforts. At the request of the PM/PE, the military unit senior engineer or a representative of the Soil Design Section will participate in the predesign conference with other design team members from Military Design Branch. The purpose of that meeting is to insure a complete understanding of the customer's requirements for the project. Through a coordinated effort with the senior engineer in the military unit of the Soil Design Section, or his representative, a draft Scope of Services (SOS) is developed. The SOS defines the scope, budget and schedule of the proposed project. Once reviewed by the senior engineer and the Section Chief, the SOS is finalized and design effort can begin.

6.2.2 Work Process: The work begins with the assignment of the project to a military unit geotechnical engineer. Both experience and workload requirements are considered in the assignment. Customer quality is assured by review of geotechnical reports and plans and specifications by the senior engineer or through peer review. Peer review involves one engineer reviewing the design work of another engineer prior to submission to the Section Chief for final approval. Work is reviewed to insure a high quality geotechnical product is provided and that all the requirements of the SOS are met. If geotechnical work is to be contracted to an A-E firm, an engineer in the military unit of the Soil Design Section reviews the SOW prepared for A-E services to insure the geotechnical tasking effort requested of the A-E is appropriate for the project. Additionally, the plans and specifications prepared by the A-E are reviewed to insure a quality product is developed. Quality of the military unit work is also enhanced through the use of the District's Criteria Management Unit (CMU). The CMU insures that the latest guidance and applicable criteria is readily available to all District personnel. The Soil Design Section's participation in the Automated Review Management System (ARMS) further enhances quality control by providing a centralized, readily accessible forum for exchange of technical comments for plan development.

6.3 Project Support Functions

6.3.1 Periodic Inspection of Reservoir Projects: The Dam Safety Inspection Team is responsible for managing the periodic inspection program and conducting the annual pre-flood inspections and/or special inspections of the District's projects. All inspections are performed in accordance with ER 1110-2-100, *Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures*. Refer to Appendix A for flow diagram of inspection procedure process.

6.3.2 Periodic Bridge Inspections: A structural engineer assigned to Project Support Section shall be responsible for the planning, executing and documenting of all inspections of bridges located at the District's flood control and navigation projects and will meet the minimum qualifications as stated in Federal Regulation 23, Highways - Part 650. All bridges owned or maintained by the Sacramento District and located on Civil Works projects will be inspected and inventoried to ensure their safety and structural integrity. A five-year bridge inspection program budget and schedule will be developed, routed through Operations Technical Branch for approval, and forwarded to CESPD-ED through CESPK-ED by 15 January of each year. The frequency of

inspection will be as required by ER 1110-2-111. Instrumentation data and reports on previous inspections will be reviewed prior to the inspection for areas of particular importance and for special equipment and personnel needs. Inspection times will be coordinated with project personnel and Operations Technical Branch, who will be invited to send a representative. All bridges will be inspected according to the manual *Bridge Inspector's Training Manual/90.* A formal technical report will be prepared for each inspection and will serve as a basis for determining the need for remedial work. The contents of the report will be as outlined in ER 1110-2-111. Each inspection report will be reviewed and certified for quality by a registered structural engineer with experience in bridge inspection and design, and the report will be approved by the District Commander. Approval will be secured within 60 days of the inspection. Refer to Appendix B for flow diagram for inspection procedure process.

6.3.3 Dam Safety Assurance: The Dam Safety Assurance Program (DSAP) evaluates and makes safe, completed Sacramento District dams and related facilities as new hydrologic and seismic data becomes available and the engineering state-of-practice evolves pertaining to hydrologic and seismic analysis, design, and remediation. The DSAP is also responsible for addressing other safety issues related to dams, such as: static stability and seepage studies, spillway erosion studies, and the impact of spillway flows on downstream lands. Seismic safety studies of dams are performed in accordance with ER 1110-2-1155 and documented by the DSAP Evaluation Report. Each stage of the evaluation process is validated by appropriately timed Policy Compliance and Criteria Reviews (PCCRs). The evaluation process consists of the following steps.

a. A seismic safety review is performed based on pertinent and readily available information. Field investigations and office studies are limited to those necessary to determine if a safety problem exists and to recommend further action. A PCCR may be conducted at this stage.

b. Based on the scope of further action recommended in the seismic safety review, a Phase I Special Study is performed. Additional investigations and simplified engineering analyses are performed to determine if the project is clearly safe, clearly unsafe, or the issue cannot be resolved at this level of study. A PCCR is typically conducted at this stage.

c. If necessary, additional investigations and detailed, multi-dimensional dynamic analyses are performed as part of a Phase II Special Study to determine the scope of the safety problem. A Phase II Special Study includes the design and cost estimate to complete modifications. A PCCR is typically conducted at this stage.

d. Upon approval of the DSAP Evaluation Report, a Design Memorandum and plans and specifications are prepared with Construction General (CG) funds leading to construction of the modifications.

Hydrologic safety studies are performed in accordance with ER 1110-2-1155 and consists of the following steps.

a. Phase I is a comparative hazard assessment in which the Threshold Flood (TF) and the Base Safety Condition (BSC) are established.

b. If modifications for a flood greater than the BSC are recommended, Phase II is a required risk-cost analysis.

Refer to Appendix C for flow diagram of the Dam Safety Assurance Program process.

6.3.4 Dam Safety Training: The Dam Safety Training Team is responsible for the development and implementation of the District dam safety training program. Team members are selected by a representative of Project Support Section under the supervision of the Dam Safety Coordinator. A team member assigned the responsibility will schedule site-specific training for operating personnel every four years. The training will enable

operating personnel to be familiar with the design features and history performance of their project and to recognize abnormal conditions and take appropriate action. The training includes discussions of the project design, construction, and foundation conditions. Also, procedures for monitoring and reporting potential problem areas during normal and emergency situations are discussed. Appropriate modules of the Training Aids for Dam Safety (TADS) are utilized. At least two training exercises for emergency situations are developed and conducted during the training session. Copies of the training records are furnished the project office. Refer to Appendix D for flow diagram for the dam safety training procedure process.

6.3.5 Dam Safety Instrumentation: The dam safety team is responsible for design consideration and implementation, installation and evaluation of such data received from all District projects. This shall also include instrumentation at project bridges. The team member assigned responsibility for the project will reduce, plot, and review all instrumentation data received or taken and will resolve any anomalies. Any unresolved items will be elevated to the Dam Safety Officer or his alternate. A review and evaluation of all project instrumentation data will be conducted two weeks prior to each project annual inspection and will cover the period from the last inspection to the present. The review will determine the need for additional instruments or the abandonment of instruments no longer needed for performance assessment. Any anomalies in the time-history plots will be resolved and any changes in monitoring, additions, deletions, or testing of the instrumentation will be documented. A summary of the instrumentation evaluation will be included in the main text of the periodic inspection report. An appendix to the report will contain illustrations, plates, plots, and a comprehensive evaluation of all data taken, received, and reviewed since the last periodic inspection. Where indicated, all historical data will be reviewed.

For bridge inspection reports, the structural engineer-in-charge of the bridge inspection program will include in the text a summary of the bridge instrumentation evaluation. In addition, an appendix to the report will contain illustrations, plates, plots, and a comprehensive evaluation of all data taken, received, and reviewed since the last periodic inspection. Where indicated, all historical data will be reviewed.

The annual updates for all projects will be submitted together with a letter of transmittal for District review and approval two weeks prior to said inspection. Refer to Appendix E for a flow diagram for the instrumentation data review procedure process.

6.4 Project Initiation and Coordination

No work shall be initiated prior to receipt of a Scope of Services (SOS) and funds for either In-House (I-H) or A-E design effort.

6.4.1 Overall Design Execution Responsibility and Point of Contact (POC): The Civil Works Project Manager (PM) or the Military Design Project Manager (PM)/Project Engineer (PE) shall be responsible for the overall execution of a design project to meet customer requirements. As such, the PM (Civil Works) or PM/PE (Military) shall be the single POC. The PM or PM/PE shall be responsible for ensuring that customer requirements are fully understood, that clear and accurate design criteria are established, and that guidance and direction for the designer are fully documented.

6.4.2 Project Schedule: All project schedules shall be established and maintained in Microsoft Project format based on the design requirements specified in the SOS. The schedule shall identify key interaction and submission points within the design process, and reflect the required design phases to be accomplished.

6.4.3 Budget: The PM or PM/PE shall be responsible for managing the project engineering budget within the customer's target budget. The PM or PM/PE shall coordinate and negotiate effort and costs with the appropriate Geotechnical Branch Section, and as applicable, A-E services associated with the production of Branch related products.

6.4.4 Scope of Services (SOS): The PM or PM/PE shall issue a SOS to the appropriate Geotechnical Branch Section to initiate I-H services for a specific project effort. The SOS is the execution contract and reflects the agreed upon project design schedule and budget for required services. At no time shall I-H personnel proceed with work without receipt of the SOS and funds. The use of A-E services shall be determined on the basis of available District resources and expertise, costs, schedules, and customer requirements.

6.4.5 Coordination Meetings: The PM or PM/PE shall chair necessary design team coordination meetings throughout the design period. The purpose of these meetings is to discuss evolving design requirements and changes, stimulate interdisciplinary communication and design compatibility, and generally serve as a forum to stimulate individual designers to function as an integrated design team and enhance the collective quality of the design package. The design effort shall be briefly discussed; addressing such items as compliance with requested changes to schedules; cost performance and additional funding requirements; user requested changes and impacts; resourcing requirements; etc. These meetings are primarly informational in nature, but are intended to serve as an action/decision forum when required.

6.5 Quality Plans

A Quality Control Plan (QCP) shall be prepared for every product or service, whether obtained using I-H or contract forces, updated as warranted and reviewed annually. The QCP will include the items listed in paragraph 6.a of EC 1165-2-203, as well as a description of the resources required to accomplish the activities outlined in the QCP. Routine or minor products may utilize generic QCPs consistent with overall QA/QC roles. Products involving non-routine and/or complex analyses will utilize a product specific QCP. While the QCP should be complete, it need not duplicate items of a definitional or procedural nature that are in the QMP.

6.5.1 In-House (I-H) Design: Geotechnical Branch products and services generally constitute one component of the project design; therefore, the quality control procedures for geotechnical design are incorporated into the project specific QCP. The functional element having primary responsibility for the technical quality of the product shall be responsible for development of the QCP for that product with input from all the other functional elements involved in development of the product. On those projects for which the Geotechnical Branch has lead responsibility for product development, the appropriate Branch element shall prepare the QCP, coordinating with other support elements as necessary. Work of a recurring nature, such as the routine inspection of dams and bridges, and the preparation of annual instrumentation reports is covered by generic QCPs (See Appendices F, G and H). In order for the Geotechnical Branch to effectively execute assigned work, effort must be determined, resources defined and allocated, budget and schedule established, and project specific assumptions documented. Additionally, responsibility and accountability must be delegated and assigned.

6.5.2 A-E Contracts: A-E contract Scopes of Work (SOW) shall include the requirement to submit a QCP to the Government. The QCP shall address coordination, checking, and correcting for all disciplines. The QCP shall also address a sub-period of service sufficient to satisfy the QC process and the preparation of documentation by the A-E to verify that the QCP has been implemented. The PM or PM/PE and the A-E representative should meet with the contracting Officer's Representative (COR) to emphasize the A-E QC responsibilities. An opportune time is during the first visit of the A-E to the District office, such as the prenegotiation conference. QC paragraphs shall be added to the SOW as follows:

(a) The A-E is reminded of his contractual obligation as stated in the contract clauses (FAR 52.326-23) that he is responsible for the professional quality, technical accuracy, and the total coordination of all designs, drawings, specifications, and other services furnished by this Scope of Work. The A-E shall provide a copy of the proposed Quality Control Plan concurrently with the fee proposal, but under separate cover letter. The plan shall describe the proposed quality control process, method of documenting peer review efforts, and the time line for this QC process and related correction period prior to submittal of the design documents to the Government.

(b) The A-E shall submit one set of his final QC check prints and comments to SPK with project submittal.
(c) The period of work is within the period of service specified in paragraph [___] and shall be [___] calendar days prior to submitting the documents to the Government.

A Quality Assurance Plan (QAP) shall be prepared for every engineering product or service completed by A-E contract.

6.6 Quality Mechanisms

6.6.1 Computer-Aided Design and Drafting (CADD): CADD systems are used to reduce cost and shorten design schedules by increasing productivity and capability of personnel.

6.6.2 Automated Review Management System (ARMS): ARMS will be used during review of Military design and to the maximum extent possible for review of Civil Works designs.

6.6.3 Specifications: Project specifications are an important and significant component of a final design package. Automated specifications processing systems will be used to ensure efficient and accurate specifications.

6.6.4 Training: Technical training will be encouraged to ensure adequate expertise in engineering exists to ensure quality engineering products and services.

6.6.5 Centers of Expertise: The HQUSACE Military Program Directorate decrees the use of the Transportation Systems Mandatory Center of Expertise (TSMCX) described in CEMP-ET Memorandum. Roadway designs over $3,000,000 and all airfield or railroad project designs must be sent to the TSMCX for their review.

7. Records. Geotechnical Branch files will document all actions processes, and products for each and all phases identified in paragraph 6 above. Project files shall reside in the Section having responsibility for the work.